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Mr. Bruce Halstad
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16 Nov. 1998

Dear Mr. Halstad:

The following comments deal with the Pacific Lumber Company HCP. I especially address EPIC criticisms of the HCP.

1. I am a fishery scientist with 44 years of experience as a university professor, field researcher, and population ecologist. I have spend the last 20 years as a fishery consultant, with emphasis on habitat and management of salmon and steelhead. I designed and initiated the Alsea Watershed Study in Oregon in the latter half of the 1950s, and worked on the streams involved in the logging impacts research for the first five years after the study began. My specialty during that tenure was coho salmon ecology.

2. Although I comment below mostly on the coho salmon components of the EPIC criticisms, I point out that EPIC uses inflammatory language to excess. Examples include:

> ...(the plan) utterly sacrifices sound biology ..... for economic gain.
>
> .... back-room negotiations.
>
> ....Pacific Lumber must get permission to kill endangered species and destroy habitat through preparation of the HCP.
>
> .... plan is a disaster in the making.
>
> ... readily available scientific iformation is often only selectively referenced in the HCP/SYP ....only nominal lip service to good science...

I have found through hard experience that these types of comments are counterproductive. They get in the way of rational discourse.

3. Coho salmon:

p. 4, "Take:" I think it is important to remember that killing, harassing, or harming endangered species at one life stage may or may not affect abundance or well-being of that species at another life stage. DWC-1

Two factors should be considered here. The first is that coho evolved in a geologically dynamic environment. Tectonic and volcanic activity occurs throughout their range. Catastrophic events occurred irregularly and unpredictably in coho evolutionary history. The species had to cope with events that might kill, harass, or harm them. Avoidance of disturbed areas is but one of the adaptations used by the species. Avoidance of the Toutle River, in Washington, after mudflows temporarily destroyed habitat, provides an excellent example. Toutle River coho colonized nearby spawning streams rather than wasting reproductive products in the damaged stream. I would expect avoidance of areas temporarily rendered unsuitable by landslides or fire. The Toutle River example indicates that adults that might spawn in a given stream reach, but return to find damaged habitat, will move elsewhere in the stream or into a nearby tributary to spawn, whether that damage occurred as a result of a natural landslide or one caused by roading or timber harvest.

Juvenile rearing may also temporarily suffer in the area of the stream disturbance and even downstream. This effect brings up the phenomenon of *compensation*, my second major point with respect to "take." Coho biologically "compensate" for losses in early life stages. Compensation means survival adjustment in this sense. That is, reduced survival in the fry life stage does not mean reduced adult numbers in the progeny brood year. The compensation phenomenon is elegantly demonstrated in the laboratory work of Nicholson (1954, 1955), and described for pink and chum salmon by Neave (1953). It is demonstrated in experimental populations in the laboratory by Silliman and Gutsell (1958). DWC-2

Salo and Bayliff (1958) showed that coho salmon compensate for large or small recruitments with, respectively, lower or higher survival to the smolt stage. Smolt output in Minter Creek, Washington, varied far less than adult numbers. Fraser (1969) experimentally demonstrated compensation in coho salmon and steelhead in artificial stream channels. Furthermore, although the common presumption for many years was that compensation occurs entirely within fresh water, more recent work indicates that compensation has effects that continue through adult return. An example in coho is compensation for low recruitment with rapid growth, which not only leads to greater survival in fresh water, but to greater adult survival. The reason for the latter is that larger smolts will enjoy greater adult survival, probably associated with the first few weeks or months of ocean life.

For an example of coho compensation on the northern coast of California, I extracted data from Shapovalov and Taft (1954). The data were derived from studies in Waddell Creek, California. The first plot (Figure 1) shows 6 years of survival from egg potential to smolt cohort in relation to number of females in the parent escapement. Those data appear somewhat curvilinear, although they demonstrate declining survival with higher escapements, and higher survival with lower escapements (compensation). The second plot (Figure 2) shows square-root transformed survivals in relation to adult females. The plot appears linear, and the regression is significantly negative ($n = 6$, $t = -3.08$, $p = 0.036$, adjusted $R^2 = 0.63$). Figure 3, a plot of progeny adults in relation to parent female abundance, shows no relationship. I interpret these data as indicating that egg-to-smolt survival increases as escapement is less. Shapovalov and Taft (1954) thought this was due to relaxed predation on smolts as they left the stream. This example of compensatory mortality (or survival) falls in line with the several other studies that I mentioned above. DWC-2 con.

The real issue in "take" is whether kill, harassment, or harm in one life stage translates directly to reduced adult return. The evidence is that it need not. This is not to say that "take" never translates to reduced adult coho return, for it can. However, if compensation did not occur in coho populations, the species could never cope with environmental dynamics, or even with exploitation by fisheries.

p. 14: Coho salmon are not "incredibly sensitive to high water temperatures and high concentrations of sediment." There is nothing unbelievable[1] about their tolerance levels, which are similar to those of other salmonid species. Bell (1991) shows recommended temperatures for incubation that are the same for chum, coho, pink, and sockeye salmon. Data in Brungs and Jones (1977), Jobling (1994), and Pennell and Barton (1996) demonstrate that the optimum range of temperature for coho lies within the ranges for several salmonid species. Optimal growth temperature for coho (14.8 C) compares with optimal growth temperature for brook trout (13.1-16.1 C), brown trout (10.0-15.5 C), chum salmon (13.0 C), sockeye salmon (15.0 C), and chinook salmon (15.5 C). The optima for five salmon species ranges from 13.0 C to 15.5 C. The maximum weekly average temperature for growth is 18 C for coho, 18 C for sockeye, 17 C for brown trout, and 19 C for rainbow and brook trout. The maximum temperature for survival of DWC-3

[1] Webster's Encyclopedic Unabridged Dictionary of the English Language gives the following two meanings for "incredible:" 1. so extraordinary as to seem impossible; 2. not credible; unbelievable.

short exposure is 24 C for all the species in the previous sentence except for sockeye, which have a maximum of 22 C. The Washington Department of Natural Resources uses 15.6 C as a threshold for temperature stress, and 24.5 C as a conservative estimate of incipient lethal temperature for juvenile coho, based on lab tolerance studies by Brett (1952) and Averett (1968). OWC-3 CON.

Bisson et al. (1988) studied habitat use and summer production of stocked underyearling coho from 1983-1986 in three streams affected by the Mt. St. Helens eruption; two in the blast area and one on a volcanic mudflow terrace. Although pool habitat and LWD was scarce at all study sites, production by coho was equal to or greater than summer production estimates for wild age 0 coho in other streams in the northwestern U.S. Summer water temperatures were very high at all sites. Bisson et al. (1988) examined coho performance in the study streams in relation to temperature. They found that temperature remained above 15.6° C from 25% to 35% of the time in the blast area streams and 15-20% of the time in the mudflow stream. In one blast-area stream (Hoffstadt Creek), temperatures remained above 24.5° C for about 125 h, 35 h, and 40 h in 1984, 1985, and 1986, respectively. In the mudflow stream (Herrington Creek, temperature remained above 24.5° C for about 115 h in 1984. Yet production over the five summer months equaled about 5, 3, and 10 g/m^2 in the 3 successive study years in Hoffstadt Cr., 5.5, 10, and 21 g/m^2 in Schultz Cr., and 2.2, 5, and 9 g/m^2 in Herrington Cr. These production levels equaled or exceeded summer production for wild age 0 coho in Chapman (1965), Burns (1972), and Dolloff (1983). In comparable headwaters of Washington's Deschutes River, less than 100 km away, production in an old-growth watershed ranged from 2-4 g/m^2, and in a watershed mostly clear-cut ranged from 4.6-5.3 g/m^2 (Bilby and Bisson 1987).

p. 14, next to last para., final sentence: This depends upon whether the stream in question lies in the fog belt or in areas affected by temperature increases upstream from that belt, or has components in both situations. OWC-4

p. 14, last paragraph: The EPIC comments should note that it was conservation agency policy that led to widespread deliberate removal of LWD from salmon streams in California and other coastal states. OWC-5

p. 15, first full paragraph: EPIC criticizes failure by Palco to cite easily-accessed literature, then fails to provide citations that document the assertions in this paragraph. While it is true that logging and road building on steep, erodible hillsides ***can*** flush fines into streams, and ***can*** form "a concrete-like layer," it would be useful to cite some specifics that are particularly pertinent in the OWC-6 northern California area.

p. 15, last full para., and top para. p. 16: Surely IPIC is not blaming "these (forest) practices" for a decline from 125,000-400,000 to 10,000 without reference to other factors. Is overfishing that leads to selective pressures that favor less-adaptive members of the population (van den Berghe and Gross 1984; NRC 1995), or to reduced transfer of marine nutrients (Cederholm et al. 1989; Kline et al. 1990; Bisson 1996; Bilby et al. 1998) unimportant? One would also want to cite ocean productivity declines (see Ware and Thomson 1991; Beamish and Bouillon 1993; Pearcy 1996, 1997; McGowan et al. 1998)). Urban creep into floodplains and conversion of floodplains to diked pastures surely should be mentioned (Peterson 1982; Bisson 1996; NRC 1995). Connections from streams to estuarine wetlands and sloughs have been cut off; an extremely important degradation component along California's northern coast. If land management in forested areas were the only concern, coho would be in good shape in areas not subjected to timber management. DWC-7

p. 17, para. 2, last sentence: I see no reason why monitoring and enforcement cannot work in stopping road work during storms. DWC-8

p. 17, para 3: It is my impression that there is an ongoing program to rectify "continuing problems." Removal of failing Humboldt crossings is an example. DWC-9

p. 17, buffer zones: In the second sentence, "codified" implies that there is only one answer in the buffer issue, and that FEMAT had it, and for all time. This approach would deny the utility of adaptive management and site-specific conditions. The utility of width increments in buffer zones decreases as width of the zone increases (USDA 1993). The first few feet of buffer provides deciduous shade, leaf fall, and habitat for terrestrial insects, some of which fall onto the stream surface where they may be consumed by fish. Additional footage provides more shading and some sources of LWD. But the increment from 170 feet out to FEMAT's 300 feet provides very little in additional recruitment of LWD, or in shading. FEMAT (USDA 1993) reported that a 30 m buffer thermally shades just as well as the protection provided by an old-growth forest. DWC-10

One should not presume that old growth is always the best habitat for coho salmon. It is important to recall that buffered and clear-cut stream segments have been found to have more algae, benthos, and salmonid fry than old-growth reaches.(see Koski et al. 1984; Bilby and Bisson 1987; Wipfli 1997; also see Chapman and Knudsen 1980, and Bisson 1996).

p. 20, para. 1: It would be useful if a cite or two could accompany the statement that "..retention of mature forest on these steep, erodible watercourses is essential to ensure water quality and prevent....., etc." If the science is that good (cf. "...This failed approach completely contradicts good science.....'), it ought to be cited. DWC-11

p. 20, last para.: ".... incredibly steep hillsides...?" This is hyberbole. The steepness is not unbelievable or extraordinary. There are plenty of slopes along the Pacific rim that are just as steep as the steep ones in Palco holdings. DWC-12

p. 21, para. 1: The comments might want to mention the presence in 1998 of high densities of steelhead juveniles in Bear Creek, one year after the 1997 event. DWC-13

Unfortunately, neither Pacific Watershed Associates nor anyone else can tell us what fraction of the sediment that reached Bear Creek after the torrent would have come from the fraction of the watershed that was logged, had it not been logged. When rains extend over a long period at very high intensity, land slides will occur even in undisturbed old-growth or older young growth. DWC-14

4. I consider the HCP/SYP a reasonable prescription for improving habitat for coho salmon over time, coupled with continued economic utilization of Palco holdings. I have read other draft and final HCPs, and find the HCP/SYP a superior product in comparison. Contrary to what EPIC says, the document does apply available information on fish ecology and fish/sediment interactions. It would be possible to improve protective and mitigative measures for coho ***if one could manage Palco lands and waters for the single purpose of producing coho habitat and coho salmon***. One could, with unlimited fund availability, set out to correct every potential erosion source left by past logging. One could spend many millions of dollars on in-stream habitat modification. One could put many or all roads to bed. But that is not the way the world works on private lands, or even on U.S. Forest Service and BLM lands. I doubt that Palco would have much interest in single-use management for coho salmon, or in spending the many millions of dollars each year for coho conservation, without reaping an economic return from timber management. DWC-15

I think the most practical and reasonable way to produce an upward trend in freshwater habitat and reduce take of coho is to follow the prescriptions in the HCP/SYP. The worst way would be to stop all land management activities that produce revenue, then hope for the best. That cessation would essentially stop stormproofing of road system, replacement of Humboldt crossings, culvert improvements, etc. It would lead to sequential, inevitable, althought irregular, failure of problem spots left by historic management practices.

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